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Is the Australian Wool Futures Market Efficient?

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Abstract

It has been suggested by Giles and Goss (1980) that if a futures market provides a forward pricing function, then it is an efficient market. This paper proposes a simple test for whether the Australian wool futures market is efficient. The test is based on applying cointegration techniques to test the Law of One Price over a three, six, nine and twelve month spread of futures prices. We found that the futures market is efficient for up to a six months spread, but no further into the future. As futures market prices can be used to predict spot prices up to six months in advance, wool growers can use the futures price to assess when they market their clips, but not for longer-term production planning decisions.

1. Introduction

Giles and Goss (1981, p. 2) suggest the four main functions that futures markets perform are to:

- facilitate risk management, as they provide a hedging facility;

- facilitate stock-holding, as the difference between the futures price and the spot price is a guide for inventory control and may be interpreted as a price of storage;

- act as a centre for the collection and dissemination of information; and

- perform a forward pricing function, as futures prices can be interpreted as an indication of what the market can anticipate to be the subsequent cash price.

The first two functions lead to the appraisement of the futures market as performing the role of an insurer, while the last two would lead to conclusions regarding its role at providing information. In this study the forward pricing function of the wool futures market is considered. The importance of this function resides in its role as an assessment of whether the market is efficient[1]. Market efficiency is an important concept in futures markets because inefficiencies lead to speculators entering the market and extracting more than normal rent.

Giles and Goss (1980 & 1981)-(GG) studied the forward pricing function of Australian wool futures and found that wool future price was an unbiased predictor of the spot price up to a period of 12 months in advance. However, as Reserve Price Scheme operated then which stabilised the spot price for wool, their assessment of the predictive ability of the futures market could be called into question. In addition, since their study was undertaken time series techniques have improved.

In this study, the period under assessment does not include the operation of the Reserve Price Scheme. Further, new techniques of time-series, particularly cointegration, are employed to gain results which can then be used to check the validity of GG's findings. They used ordinary least squares techniques to undertake their analysis which creates problems if cointegration exists as the distributions of the calculated F-statistics and t-ratios are not standard.

[1] Market Efficiency in this case is defined as the Futures Market price adequately reflecting the spot price.

2. Futures Market Efficiency

2.1 Conceptual framework

According to Tomek and Gray (1970), as the wool market is a continuous inventory commodity market it should adequately perform a forward pricing function. If the market is efficient then the futures price can be used to predict the spot price. This can be seen by considering the following model:

$$P_{s,t+1} = \beta_o + \beta_1 P_{f,t} + e_{t+1} \qquad (1)$$

where $P_{s,t+1}$ is the wool spot price at time period t+1;

$P_{f,t}$ is the wool futures price at time period t of period t+1;

e_{t+1} is the error term with $E(e_t) = 0$ and $E(e_t^2) = \sigma^2$;

β_o is the intercept term; and

β_1 is the slope coefficient.

If β_o equals zero and β_1 equals one, this model will satisfy the Law of One Price. If results vary slightly from the Law of One Price, the futures price can be said to be reflective of the spot price. Enders (1995, p.6) argues that "..the unbiased forward rate hypothesis asserts that expected profits from speculative behaviour should be zero...". The relationship between forward and spot exchange rates is similar to that specified in equation (1). Thus, in theory, the futures price at time t is an unbiased estimate of the spot price in the following time period, t+1[2].

Using time-series techniques it is possible to estimate an equilibrium correction model of the relationship between the wool futures and spot prices. An equilibrium correction model provides not only the long-run relationship parameters, as estimated in GG study, it also provides speed of adjustment coefficients which are the short-run parameters. Within this model, if the futures and spot prices are in disequilibrium in the short-run, the speed of adjustment coefficient provides an estimate of the path needed to return to equilibrium as well as an insight into the causal relationship (in the Granger sense) between futures and spot prices. In summary, using equilibrium correction techniques both a test for efficiency and a forecasting model are provided.

In order to conclude that the Australian wool futures market is efficient, the data must support the proposition that:

1. $\hat{e}_t$ is 'well behaved' since e_t is a stationary zero mean process by assumption, which translates to a test that the futures and spot prices are cointegrated; and

2. the joint hypothesis that $\beta_o = 0$ and $\beta_1 = 1$.

If propositions 1. and 2. hold, then there is evidence that, for a given time spread, the futures price is an unbiased predictor of the spot price. That is, the evidence indicates that on average in the long-run;

$$P_{s,t+1} = P_{f,t} \tag{2}$$

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[2] It should be noted that the forward rate hypothesis, the Law of One Price and the tests for boarder price state

This study's approach to testing market efficiency is based on an equilibrium correction model of the wool market. Through this approach we assess propositions 1 and 2 for different horizons as well as for Granger causality.

2.2 Testing for Futures Market Efficiency

Formally, we can model the futures and spot prices as follows:

$$\Delta P_{st} = -\alpha_s (P_{s,t-1} - \beta_o - \beta_1 P_{f,t-1}) + \varepsilon_{st}, \quad (3.1)$$

$$\Delta P_{ft} = \alpha_f (P_{s,t-1} - \beta_o - \beta_1 P_{f,t-1}) + \varepsilon_{ft}, \quad (3.2)$$

where,

$P_{s,t-1}$ = spot price at time t-1

$P_{f,t-1}$ = futures price for time t-1 (at time t-2)[3]

$\Delta P_{st} = P_{st} - P_{s,t-1}$

$\Delta P_{ft} = P_{ft} - P_{f,t-1}$

$\alpha_i > 0$ are the speed of adjustment coefficients; i = s,f; and

ε_{st} and ε_{ft} are white noise.

Once equations (3.1)-(3.2) are estimated the following can be obtained:

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the same principle within different economic contexts.

[3] Note that the notation has been changed slightly from equation (1) for easier exposition. The futures price's subscript now denotes the time period that it is predicting

1. estimates of the long-run elasticities (β_o and β_1) which are the cointegrating parameters if they exists;

2. test for efficiency as described in section 2.1; and

3. an assessment of causality between futures and spot prices.

According to Granger (1988), if futures and spot prices are cointegrated, then there is causality in at least one direction. Further, if one of the $\alpha_i = 0$ (where i = f,s), then the direction of the causality in a two variable system is established. Suppose that α_s is equal to zero, then (3.1) and (3.2) would equal:

$$\Delta P_{st} = \varepsilon_{st}; \text{ and} \tag{3.1'}$$

$$\Delta P_{ft} = \alpha_f (P_{s,t-1} - \beta_o - \beta_1 P_{f,t-1}) + \varepsilon_{ft} \tag{3.2'}$$

Then, if $P_{s,t-1} - \beta_o - \beta_1 P_{f,t-1} \neq 0$, the adjustment of the futures price will respond to this disequilibrium while the time path of the spot price would not. In this case, it is said that the spot price "Granger causes" the futures price, while the converse is not true.

2.3 Data Requirements

All futures price data used in this analysis were downloaded from the Sydney Futures Exchange Web Page on the Internet. Historical data on wool futures prices and their settlement prices for trading days, dating back to December 1991 were obtained. The Sydney Futures Exchange (SFE, 1997) defines the settlement price as:

> "the midpoint of the closing bid and offer. If only one is available, then the closing bid (or offer) is used. If there is no closing bid (or offer) then the

previous day's settlement is adjusted to maintain the differential to the spot month contract".

The settlement price is used in this study as it is a consistent series of data going back as far as December 1991. Other data series that could have been chosen suffered from reporting breaks which limit the number of observations. Choosing for any earlier series involved the inclusion of the Reserve Price Scheme, which reduced trading volumes and created too much volatility when the market price was falling. Furthermore, choosing such a data set would lead to some of the bias thought to exist in GG's work. Data on the spot price for wool, which fitted the specification by the futures contract, were obtained from Wool International (1997 and earlier issues) and its predecessor the Australian Wool Corporation (1993 and earlier issues). The last day of trading for a wool futures contract is noon on the third Thursday of the contract month. Thus, the choice of the contract spot price is a relatively straight forward. The indicator price from the week containing the third Thursday of the month was taken as the spot price that is used to compare the corresponding futures prices. While this is not the exact day's price for the end of trading, it is the best available indicator of the spot price for wool at that point in time. Prior to the Greasy Wool Futures listing in mid-1995, when the Wool (cash settlement) Futures were traded, trading ceased on the business day following the last day of wool auction sales in the month in question. Despite this, the same method for determining the spot price was applied to the Wool (cash settlement) Futures as outlined above as, in all but the rarest of cases, this turned out to be the third Thursday of the trading month.

Taking futures price data on a daily basis is not desirable as the futures price in many cases does not change from one day to the next. Therefore, the futures price data were aggregated into weekly averages for analysis. The analysis included four time spreads. Following the practice used in past studies, notably GG, it was decided that the three, six, nine and twelve month price spreads need to be analysed. This involves taking futures price data and matching it to spot price data with a spread of three, six, nine and twelve months between each series corresponding observation. Consequently, four different spot price series were obtained each corresponding to the one futures price series.

A further problem arose as the data contained a structural break in all the time spreads, when the change was made to a tradeable futures contract. The cash settled wool futures were de-listed on the 4th of September 1995 and replaced by the new, and currently traded, deliverable wool futures contract. The contract was changed from a 22 micron wool to a 21 micron wool. There were also other changes to the contract including the physical delivery of the settlement requirement for outstanding contracts on maturity, and a change in the specification of end of trading day. To assess the problem associated with a structural break in the data a pulse dummy was included in the analysis. The structural breaks occurred at different points in each of the time spreads with the break occurring at observation number 100 for the three months spread, observation number 98 for the six months spread, observation number 93 for the nine months spread and observation number 88 for the twelve months spread.

Graphical representations of all the series used in the three, six, nine and twelve month time spreads are presented (see Figures 1, 2, 3 and 4). In both the three and six month spread, the co-movement does seem apparent and yet do not in the other two price spreads, though tests are needed to prove whether unit roots and cointegration exist for each of the time spreads[4].

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[4] All the tests and analysis were conducted using the Regression Analysis of Time-Series (RATS) and the Cointegration Analysis of Time-Series (CATS) packages.

Figure 1 Three Month Futures and Spot Price Series

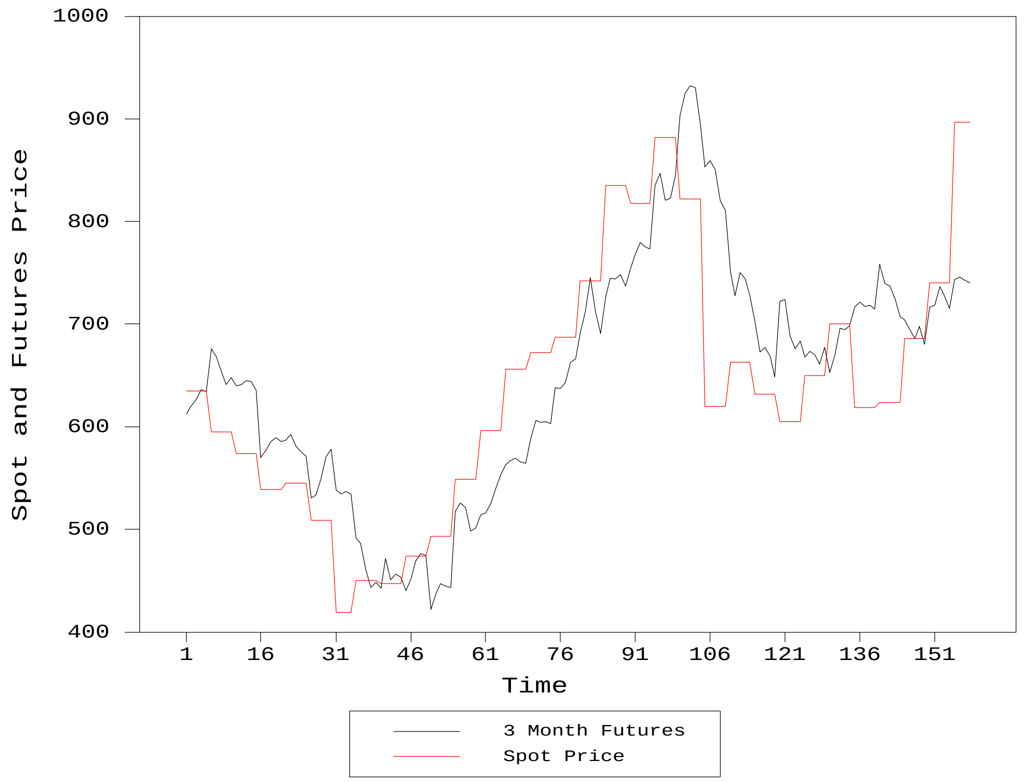


Figure 2 Six Month Futures and Spot Price Series

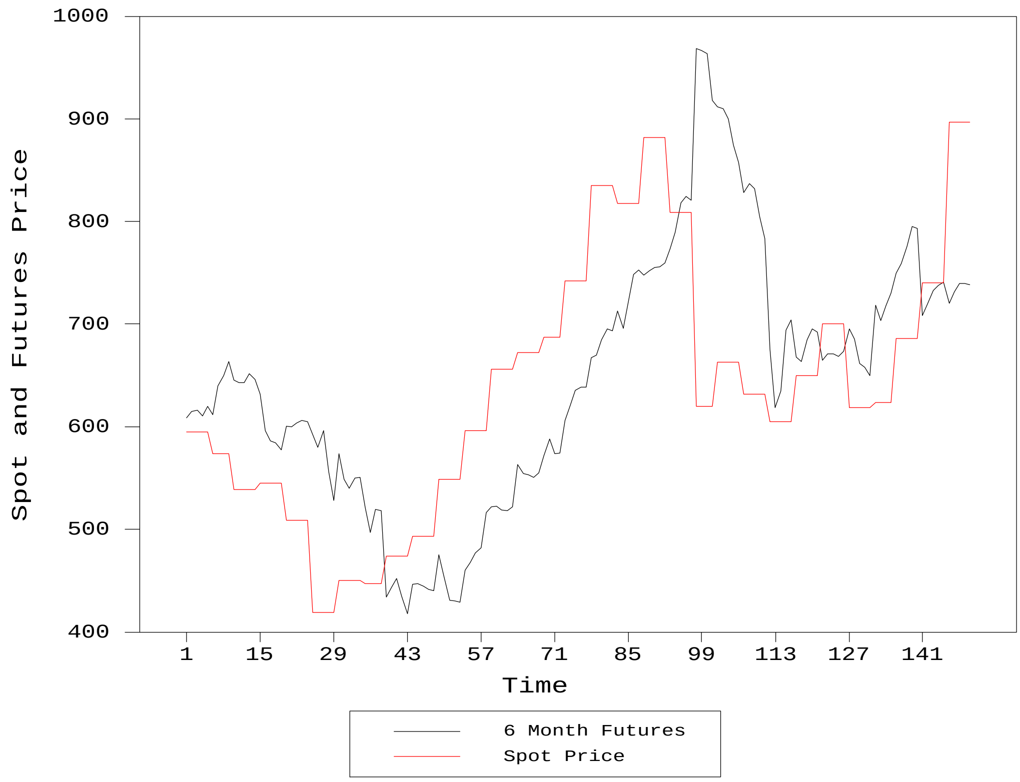


Figure 3 Nine Month Futures and Spot Price Series

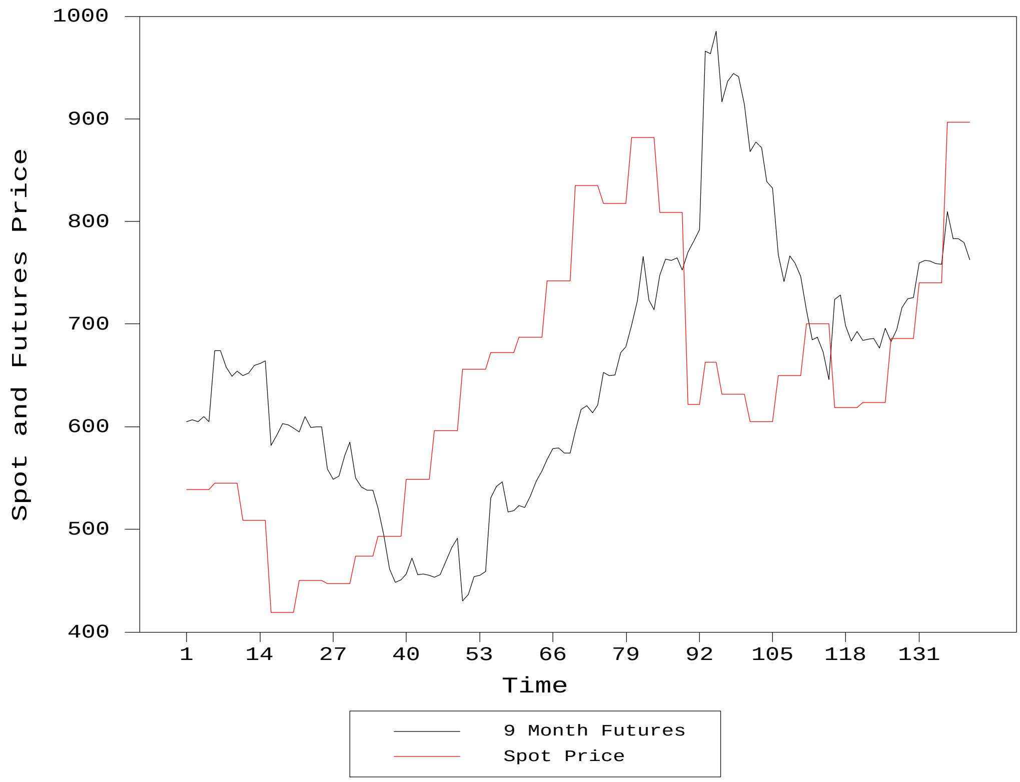
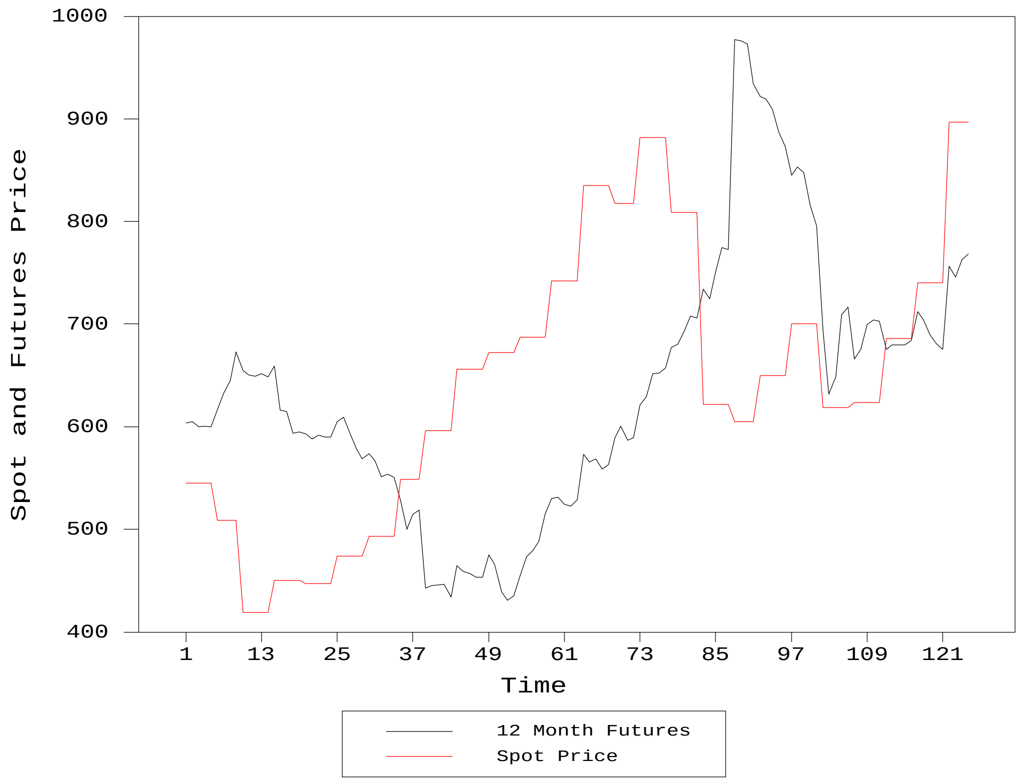


Figure 4 Twelve Month Futures and Spot Price Series



3. Results

The first step in conducting a cointegration analysis is to analyse the spot price and futures price data series to determine whether or not a unit root exists. Detection of a unit root indicates the series is following a non-stationary process. If both the spot price and the futures price are integrated of order one then the two series must be cointegrated for a stationary linear combination to exist.

Confirmation of the structural breaks in the data was provided by using Perron's Model A (Perron, 1989, pp. 1364) to test for a unit root under a structural break. The results of the unit root tests indicated that the dummy variable representing the structural break was significant at the 5% level. This indicates the dummy variable should be included in the testing procedure. The results for the null hypothesis that a unit root does exist are presented in Table I.

Table I Unit Root Test Results

	Lags			
Dickey-Fuller Test	0	1	3	5
Futures Price Series				
12 month	-1.342	-1.623	-1.474	-2.109
9 month	-1.451	-1.485	-1.399	-1.843
6 month	-1.474	-1.678	-1.488	-1.881
3 month	-1.474	-1.569	-1.544	-1.984
Spot Price Series				
12 month	-2.939	-2.987	-3.115	-3.047
9 month	-3.335	-3.422	-2.583	-3.005
6 month	-2.305	-2.288	-2.249	-2.284
3 month	-2.179	-2.186	-2.203	-2.011

Note: The critical values obtained were at the 5% level with $l_3 = 100/158 \approx 0.6$, the critical value is -3.76, with $l_6 = 98/150 \approx 0.7$, the critical value is -3.80, with $l_9 = 93/140 \approx 0.7$, the critical value is -3.80 and with $l_{12} = 88/125 \approx 0.7$, the critical value is -3.80, (Perron 1989).

The relevant critical values for the statistic to test for a unit root in this model depend on the proportion $\lambda = \tau/T$, where T is the total number of observations and τ is the observation number at which the break occurs.

There are four different values for λ, one for each different spread of futures. The λ values are presented with subscripts depicting to which spread each critical value applies.

As all the t_{calc} values are greater than the critical values the null hypothesis that a unit root exists can not be rejected at the 95% confidence level. This indicates both the wool futures price and spot price series follow a random walk process. The Law of One Price requires a stationary linear combination of the two series to exist. This stationary linear combination of two nonstationary series is known as cointegration. If a stationary linear combination of the two series does not exist, then equation (1) is not an equilibrium relationship. This could lead to speculators gaining pure profits from trade and indicates market inefficiency arising from poor price prediction.

The next step in a cointegration analysis is to use vector autoregression (VAR) analysis to test for the number of lags in the model. Cointegration tests are seriously biased if too few lags are used in the model (Gonzalo, 1994). Similarly, too many lags introduce inefficiencies in the estimation of the model which may result in low power of the tests. Therefore, care must be taken to estimate the correct number of lags for the model. Testing for the correct lag length was performed with the Akaike Information Criterion (AIC) and Schwartz Bayesian criterion (SBC) for various possible lag lengths that could apply to the model. For the entire range of futures and spot price spreads the AIC and SBC values were lowest for the model which was lagged only one period (see Table II).

Table II. Lag Length Test Results

No of Lags	AIC Tests Unrestricted	AIC Tests Restricted	SBC Tests Unrestricted	SBC Tests Restricted	Result
3 Month Spread					
24 vs 12	2547.229	2310.703	2831.218	2455.595	12 lags best
10 vs 5	2438.000	2245.456	2563.883	2311.395	5 lags best
6 vs 3	2351.536	2228.044	2430.157	2270.378	3 lags best
4 vs 2	2304.191	2164.758	2358.856	2195.127	2 lags best
2 vs 1	2188.783	1981.947	2219.282	2000.246	1 lag best
6 Month Spread					
24 vs 12	2474.759	2212.273	2752.715	2354.087	12 lags best
10 vs 5	2409.984	2263.126	2533.533	2327.842	5 lags best
6 vs 3	2370.615	2201.707	2447.831	2243.284	3 lags best
4 vs 2	2295.997	2127.473	2349.702	2157.309	2 lags best
2 vs 1	2152.408	1942.752	2182.380	1960.735	1 lag best
9 Month Spread					
24 vs 12	2216.140	2086.771	2485.992	2224.450	12 lags best
10 vs 5	2309.154	2138.219	2429.591	2201.305	5 lags best
6 vs 3	2253.063	2096.447	2328.407	2137.016	3 lags best
4 vs 2	2187.951	2019.134	2240.378	2048.260	2 lags best
2 vs 1	2044.634	1851.802	2073.906	1869.366	1 lag best
12 Month Spread					
24 vs 12	1952235	1895.538	2208.517	2026.294	12 lags best
10 vs 5	2133.495	1962.464	2248.782	2022.852	5 lags best
6 vs 3	2084.769	1912.849	2157.026	1951.757	3 lags best
4 vs 2	2012.765	1836.564	2063.089	1864.522	2 lags best
2 vs 1	1862.654	1677.408	1890.776	1694.281	1 lag best

Note: Decision rule for test is the best model has the smaller AIC and SBC value.

Further lag length checks were conducted using the multivariate statistics provided in the CATS output. These tests again involve calculating AIC and SBC values and comparing the calculated values as above, and autocorrelation tests to ensure the errors display white noise characteristics. In all cases the information criteria tests were ambiguous (see Table III). The AIC test supported the two lag model as best and the SBC test supported the one lag model as best. It was decided that one lag was best on the grounds of efficiency and that two of the three tests supported the one lag model.

Table III. Further Lag Length Test Results

	AIC		SBC		Result
Spread	1 Lag	2 Lags	1 Lag	2 Lags	
3 Month	1993.762	1986.421	12.816	12.929	Inconclusive
6 Month	1954.742	1949.534	13.240	13.375	Inconclusive
9 Month	1861.809	1855.023	13.521	13.654	Inconclusive
12 Month	1681.941	1676.563	13.778	13.937	Inconclusive

Note: Decision rule for test is the best model has the smaller AIC and SBC value.

The three tests conducted for residual autocorrelation were a Ljung-Box (L-B) test and two Lagrange Multiplier (LM) type tests for first and fourth order autocorrelation. The tests indicate a white noise process in the error term if the p-value is greater than 0.05, at the 95% confidence level. A value of less than 0.05 could indicate an incorrect choice of lag length. Autocorrelation test results were favourable for all the one lag models with p-values being greater than 0.05 (see Table IV). For a six month spread the two lag models had one of the three p-values less than 0.05 which seems to be an outlier. The twelve month spread performed poorly with both one and two lag models showing p-values less than 0.05. This may be indicative of the problems with the twelve month spread that will be dealt with shortly.

Table IV. Residual Autocorrelation Test Results

	Ljung-Box Test		Lagrange Multiplier Test (first order autocorrelation)		Lagrange Multiplier Test (fourth order autocorrelation)	
Spread	1 Lag	2 Lags	1 Lag	2 Lags	1 Lag	2 Lags
3 Months	0.91	0.89	0.34	0.73	0.86	0.85
6 Months	0.12	0.12	0.74	0.03	0.57	0.46
9 Months	0.04	0.02	0.57	0.04	0.76	0.85
12 Months	0.03	0.02	0.77	0.00	0.70	0.60

Note: Values in the table are p-values. Rejection rule: reject the null of no autocorrelation if the p-value is greater than 0.05.

Following the determination of the number of lags required in the model, the tests for cointegration can be undertaken. The model estimated was of the form specified in equations (3.1) and (3.2) with the inclusion of the pulse dummy as an exogenous variable. The Johansen procedure can be used to test for the existence of cointegration and the number of independent cointegrating vectors, also known as the cointegrating rank. The tests are likelihood ratio tests known as the Lambda Max and the Lambda Trace tests. A calculated Lambda greater than the critical Lambda value leads to rejection of the null hypotheses of the rank equal to zero or one under the Lambda Max and the rank equal to zero, or less than or equal to one, under the Lambda Trace test (see Tables V, VI and VII).

Table V. Lambda Max and Lambda Trace Tests for Three Month Spread

	H_o	l_{calc}	l_{crit}	Reject H_0
Lambda Max				
	r = 0	24.29	15.752	Yes
	r = 1	2.14	9.094	No
Trace Test				
	r = 0	26.43	20.168	Yes
	r $\leq$ 1	2.14	9.094	No

Table VI. Lambda Max and Lambda Trace Tests for Six Month Spread

	H_o	l_{calc}	l_{crit}	Reject H_0
Lambda Max				
	r = 0	18.53	15.752	Yes
	r = 1	1.82	9.094	No
Trace Tests				
	r = 0	20.34	20.168	Yes
	r $\leq$ 1	1.82	9.094	No

Table VII. Lambda Max and Lambda Trace Tests for Nine Month Spread

	H_o	l_{calc}	l_{crit}	Reject H_0
Lambda Max Test				
	r = 0	7.66	15.752	No
	r = 1	4.45	9.094	
Trace Test				
	r = 0	12.11	20.168	No
	$r \leq 1$	4.45	9.094	

Table VIII. Lambda Max and Lambda Trace Tests for Twelve Month Spread

	H_o	l_{calc}	l_{crit}	Reject H_0
Lambda Max				
	r = 0	7.27	15.752	No
	r = 1	3.56	9.094	
Trace Tests				
	r = 0	10.83	20.168	No
	$r \leq 1$	3.56	9.094	

From the results of these tests it would appear that cointegration with rank equal to one exists between the futures and spot prices for spreads of three and six months. So the three and six months spread models are cointegrated with one cointegrating vector. There is no evidence to suggest that cointegration exists between the futures and spot price series with a nine or twelve months spread. As a consequence the nine and twelve months spreads were not included in the cointegration modelling from this point on. As an interesting point note that in Figures 1 and 2, three and six month spreads appear to exhibit co-movement on a visual inspection. Yet this same can not be said for the nine and twelve months spreads in Figures 3 and 4.

Estimates of model are presented in Table IX below. The estimated cointegrating vector parameters (β_i) and speed of adjustment coefficients (α_i) along with the t-values for the speed of adjustment coefficients are reported. The cointegrating vectors were normalised with respect to the spot price parameter during the estimation of both the three and six month spread. Furthermore, it is expected that the spot price will affect the futures price and the futures price will not affect the spot price. Thus, in this analysis an attempt is made to measure the effect a change in the spot price has upon the futures price. Another way of stating this question is to ask, does the spot price "Granger cause" the futures price and does the futures price "Granger cause" the spot price ?

Table IX. Estimated Cointegrating Vector Parameters and Speed of Adjustment Coefficients for Three and Six Month Spreads*

	$\hat{\beta}_f$	$\hat{\beta}_s$	$\hat{\alpha}_f$	$\hat{\alpha}_s$
Three Month Spread	-1.023	1.000	0.116**	0.037
			(5.125)	(1.118)
Six Month Spread	-1.009	1.000	0.072**	0.012
			(4.080)	(0.571)

* Subscript ‘f’ indicates futures price coefficient and subscript ‘s’ indicates spot price coefficient.

** Values in brackets are t-values, significant at the 1% level.

In both the three and six month spreads the results yield a t-value of less than 1.96 for the α_S values. Thus α_S values are not significantly different from zero giving support to the spot price model of the form (3.1'). Note that the estimated futures price cointegrating vector parameters (β_{3f} = -1.023, β_{6f} = -1.009) are close to one. As stated in Section 2.1, if the futures and spot prices are cointegrated, then the wool futures market is efficient for the given time spread if there is evidence to support the null:

H_o : $\beta_o = 0$ and β_1=1

H_1: at least one does not

The likelihood ratio test yielded a value of 0.30 (p-value = 0.86) for the three month spread, while for the six month spread the likelihood ratio test yielded a value of 0.14 (p-value = 0.93). Thus, for the three and six month spreads, using likelihood ratio tests, the null hypothesis that the cointegrating vector between spot and futures prices β' is equal to [1 -1] could not be rejected. That is, in the notation of equations (3) and (3'), $P_{s,t} - P_{f,t} = 0$.

These results suggests that the adjustment of futures price depends on the long-run disequilibrium between spot and futures prices, while the adjustment of the spot price is independent of the long-run disequilibrium. Thus, the empirical evidence supports Granger causality from the spot to the futures price, but not the reverse. This is the expected result in accordance with the Law of One Price.

4. Discussion of Results - The Speed of Adjustment

The results of this analysis (with all the restriction imposed) indicate that the following models are supported by the data:

For the three month spread:

$$\Delta \hat{P}_{f3,t} = 0.118\ (P_{s3,t-1} - P_{f3,t-1}) \quad (4.1)$$

$$\hat{P}_{f3,t} = P_{f3,t-1} \quad (4.2)$$

For the six month spread:

$$\Delta \hat{P}_{f6,t} = 0.074\ (P_{s6,t-1} - P_{f6,t-1}) \quad (5.1)$$

$$\hat{P}_{f6,t} = P_{f6,t-1} \quad (5.2)$$

These results are encouraging as they imply a futures market that is working in an efficient manner and one that is providing a forward pricing function, for the three and six month spreads. The estimated model reported above indicates that a movement in the spot price is causing a correction to the futures price.

It was also found that the futures respond faster to a change in the spot price in the three month futures, than the six month futures. This is shown by the smaller speed of adjustment value in the six month futures model. As three month futures are closer to their expiration of contract than six month futures, it seems reasonable to find a faster response to disequilibrium.

The results estimated in this study confirm some of those of GG. The results also add to our knowledge by finding that cointegration does exist and by providing estimates of the short-run effect of spot price movements on the futures price.

In the case of the nine and twelve months futures no cointegration was found. This raises the question of whether these futures contract's existence is justified. If nine and twelve months futures are not cointegrated with the spot price, then the error correction relationship does not exist and consequently, the stabilising role of the nine and twelve months futures could be questioned. If there is no stabilising role for the nine and twelve months futures then it could be argued that there may be a detrimental effect on the wool market. The market may well perform better without the nine or twelve months future traded. Alternatively, efforts to increase the effective dissemination of information beyond six months may be improved. However, these questions cannot be answered without further analysis.

An interesting question arising from this research is whether it would be feasible for the Sydney Futures Exchange to introduce more wool futures contracts to cover a broader range of microns in the wool market. Perhaps the length of 18 months ahead could be shortened and lost business could be compensated for by an extra contract in another micron market. These questions, especially those associated with basis risk have not been assessed in this study, but may prove a fruitful line of research[5].

5. Conclusions

In summary, in this study an improved technique was used to assess whether wool futures prices are a good predictor of wool spot prices. A similar study was conducted by GG using ordinary least squares techniques. To properly test market efficiency an error correction model was estimated in this study. Market efficiency was established to exist for the three and six months spread. This technique also made possible to estimate the path of adjustment futures prices will follow when they move from a position of disequilibrium to equilibrium. In addition, Granger causality from spot to futures prices was found.

[5] Authors have learned that the Sydney Futures Exchange has started trading 19 and 23 micron wool futures as of 19 January 1998.

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